

PATENT COOPERATION TREATY

PCT

NOTIFICATION OF ELECTION
(PCT Rule 61.2)

Date of mailing: 11 January 2001 (11.01.01)	ETATS-UNIS D'AMERIQUE in its capacity as elected Office
International application No.: PCT/EP00/06028	Applicant's or agent's file reference: 99 0601 P
International filing date: 28 June 2000 (28.06.00)	Priority date: 30 June 1999 (30.06.99)
Applicant: WIEDEMER, Manfred et al	

1. The designated Office is hereby notified of its election made:

in the demand filed with the International preliminary Examining Authority on:

07 November 2000 (07.11.00)

in a notice effecting later election filed with the International Bureau on:

2. The election was

was not

made before the expiration of 19 months from the priority date or, where Rule 32 applies, within the time limit under Rule 32.2(b).

<p>The International Bureau of WIPO 34, chemin des Colombettes 1211 Geneva 20, Switzerland</p> <p>Facsimile No.: (41-22) 740.14.35</p>	<p>Authorized officer:</p> <p>J. Zahra</p> <p>Telephone No.: (41-22) 338.83.38</p>
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10/809160
Translation

PATENT COOPERATION TREATY

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Technology Center 2600

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INTERNATIONAL PRELIMINARY EXAMINATION REPORT

(PCT Article 36 and Rule 70)

Applicant's or agent's file reference 99 0601 P	FOR FURTHER ACTION See Notification of Transmittal of International Preliminary Examination Report (Form PCT/IPEA/416)	
International application No. PCT/EP00/06028	International filing date (day/month/year) 28 June 2000 (28.06.00)	Priority date (day/month/year) 30 June 1999 (30.06.99)
International Patent Classification (IPC) or national classification and IPC B41J 2/005		
Applicant OCÉ PRINTING SYSTEMS GMBH		

1. This international preliminary examination report has been prepared by this International Preliminary Examining Authority and is transmitted to the applicant according to Article 36.

2. This REPORT consists of a total of 5 sheets, including this cover sheet.

This report is also accompanied by ANNEXES, i.e., sheets of the description, claims and/or drawings which have been amended and are the basis for this report and/or sheets containing rectifications made before this Authority (see Rule 70.16 and Section 607 of the Administrative Instructions under the PCT).

These annexes consist of a total of _____ sheets.

3. This report contains indications relating to the following items:

- I Basis of the report
- II Priority
- III Non-establishment of opinion with regard to novelty, inventive step and industrial applicability
- IV Lack of unity of invention
- V Reasoned statement under Article 35(2) with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement
- VI Certain documents cited
- VII Certain defects in the international application
- VIII Certain observations on the international application

Date of submission of the demand 07 November 2000 (07.11.00)	Date of completion of this report 05 February 2001 (05.02.2001)
Name and mailing address of the IPEA/EP	Authorized officer
Facsimile No.	Telephone No.

INTERNATIONAL PRELIMINARY EXAMINATION REPORT

International application No.

PCT/EP00/06028

I. Basis of the report

1. With regard to the elements of the international application:*

the international application as originally filed

the description:

pages 1-18, as originally filed
 pages _____, filed with the demand
 pages _____, filed with the letter of _____

the claims:

pages 1-19, as originally filed
 pages _____, as amended (together with any statement under Article 19)
 pages _____, filed with the demand
 pages _____, filed with the letter of _____

the drawings:

pages 1/4-4/4, as originally filed
 pages _____, filed with the demand
 pages _____, filed with the letter of _____

the sequence listing part of the description:

pages _____, as originally filed
 pages _____, filed with the demand
 pages _____, filed with the letter of _____

2. With regard to the language, all the elements marked above were available or furnished to this Authority in the language in which the international application was filed, unless otherwise indicated under this item.

These elements were available or furnished to this Authority in the following language _____ which is:

the language of a translation furnished for the purposes of international search (under Rule 23.1(b)).
 the language of publication of the international application (under Rule 48.3(b)).
 the language of the translation furnished for the purposes of international preliminary examination (under Rule 55.2 and/or 55.3).

3. With regard to any nucleotide and/or amino acid sequence disclosed in the international application, the international preliminary examination was carried out on the basis of the sequence listing:

contained in the international application in written form.
 filed together with the international application in computer readable form.
 furnished subsequently to this Authority in written form.
 furnished subsequently to this Authority in computer readable form.
 The statement that the subsequently furnished written sequence listing does not go beyond the disclosure in the international application as filed has been furnished.
 The statement that the information recorded in computer readable form is identical to the written sequence listing has been furnished.

4. The amendments have resulted in the cancellation of:

the description, pages _____
 the claims, Nos. _____
 the drawings, sheets/fig _____

5. This report has been established as if (some of) the amendments had not been made, since they have been considered to go beyond the disclosure as filed, as indicated in the Supplemental Box (Rule 70.2(c)).**

* Replacement sheets which have been furnished to the receiving Office in response to an invitation under Article 14 are referred to in this report as "originally filed" and are not annexed to this report since they do not contain amendments (Rule 70.16 and 70.17).

** Any replacement sheet containing such amendments must be referred to under item 1 and annexed to this report.

INTERNATIONAL PRELIMINARY EXAMINATION REPORT

International application No.
PCT/EP 00/06028

V. Reasoned statement under Article 35(2) with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement

1. Statement

Novelty (N)	Claims	1-19	YES
	Claims		NO
Inventive step (IS)	Claims	1-19	YES
	Claims		NO
Industrial applicability (IA)	Claims	1-19	YES
	Claims		NO

2. Citations and explanations

1) Claims 1 and 15 relate, respectively, to a method and a device for transferring printing ink onto a base material, having a tandem unit for receiving print data, a receiving unit for printing ink and a transfer unit.

Such a method and such a device are known from the closest prior art as per document WO-A-95/29063.

The subject matter of Claim 1 differs from that method and device:

- (i) by a unit for altering the surface tension of the printing ink provided for a particular image element, depending on the print data;
- (ii) in that the transfer unit is arranged relative to the receiving unit such that, without any substantial change in volume, a predetermined volume of printing ink with a first surface tension wets the base material; and
- (iii) in that printing ink with a second surface tension that differs from the first surface tension does not touch the base material.

The above distinguishing features result in low-

energy printing.

The application therefore addressed the problem of developing a method and a device for transferring printing ink to a base material which are simple and operate using little energy.

The solution to the above problem is neither disclosed nor suggested by the prior art cited in the search report. In particular, none of documents US-A-5 856 836, US-A-5 886 722 or US-A-5 745 128 discloses features (i), (ii) or (iii).

- 2) Dependent Claims 2-14 and 16-19 concern additional configurations of the method and printing device and likewise satisfy the PCT requirements.

VII. Certain defects in the international application

The following defects in the form or contents of the international application have been noted:

- 1) Independent Claims 1 and 15 are not drafted in the two-part form pursuant to PCT Rule 6.3(b).
- 2) Page 1, line 20 of the description: the patent number EP-B-0 756 566 is incorrect. The correct number is EP-B-0 756 544. Alternatively, this patent number could have been replaced by the publication number WO-A-95/29063.
- 3) Page 7, line 33 of the description: the number 14 (Claim 14) is incorrect. The correct number is 15 (Claim 15).

VERTRÄG ÜBER DIE INTERNATIONALE ZUSAMMENARBEIT
AUF DEM GEBIET DES PATENTWESENS

PCT

INTERNATIONALER RECHERCHENBERICHT

(Artikel 18 sowie Regeln 43 und 44 PCT)

Aktenzeichen des Anmelders oder Anwalts 99 0601 P	WEITERES VORGEHEN	siehe Mitteilung über die Übermittlung des internationalen Recherchenberichts (Formblatt PCT/ISA/220) sowie, soweit zutreffend, nachstehender Punkt 5
Internationales Aktenzeichen PCT/EP 00/ 06028	Internationales Anmeldedatum (Tag/Monat/Jahr) 28/06/2000	(Frühestes) Prioritätsdatum (Tag/Monat/Jahr) 30/06/1999
Anmelder OCE PRINTING SYSTEMS GMBH		

Dieser internationale Recherchenbericht wurde von der Internationalen Recherchenbehörde erstellt und wird dem Anmelder gemäß Artikel 18 übermittelt. Eine Kopie wird dem Internationalen Büro übermittelt.

Dieser internationale Recherchenbericht umfaßt insgesamt 3 Blätter.

Darüber hinaus liegt ihm jeweils eine Kopie der in diesem Bericht genannten Unterlagen zum Stand der Technik bei.

1. Grundlage des Berichts

a. Hinsichtlich der **Sprache** ist die internationale Recherche auf der Grundlage der internationalen Anmeldung in der Sprache durchgeführt worden, in der sie eingereicht wurde, sofern unter diesem Punkt nichts anderes angegeben ist.

Die internationale Recherche ist auf der Grundlage einer bei der Behörde eingereichten Übersetzung der internationalen Anmeldung (Regel 23.1 b)) durchgeführt worden.

b. Hinsichtlich der in der internationalen Anmeldung offenbarten **Nucleotid- und/oder Aminosäuresequenz** ist die internationale Recherche auf der Grundlage des Sequenzprotokolls durchgeführt worden, das

in der internationalen Anmeldung in Schriftlicher Form enthalten ist.

zusammen mit der internationalen Anmeldung in computerlesbarer Form eingereicht worden ist.

bei der Behörde nachträglich in schriftlicher Form eingereicht worden ist.

bei der Behörde nachträglich in computerlesbarer Form eingereicht worden ist.

Die Erklärung, daß das nachträglich eingereichte schriftliche Sequenzprotokoll nicht über den Offenbarungsgehalt der internationalen Anmeldung im Anmeldezeitpunkt hinausgeht, wurde vorgelegt.

Die Erklärung, daß die in computerlesbarer Form erfaßten Informationen dem schriftlichen Sequenzprotokoll entsprechen, wurde vorgelegt.

2. Bestimmte Ansprüche haben sich als nicht recherchierbar erwiesen (siehe Feld I).

3. Mangelnde Einheitlichkeit der Erfindung (siehe Feld II).

4. Hinsichtlich der Bezeichnung der Erfindung

wird der vom Anmelder eingereichte Wortlaut genehmigt.

wurde der Wortlaut von der Behörde wie folgt festgesetzt:

5. Hinsichtlich der Zusammenfassung

wird der vom Anmelder eingereichte Wortlaut genehmigt.

wurde der Wortlaut nach Regel 38.2b) in der in Feld III angegebenen Fassung von der Behörde festgesetzt. Der Anmelder kann der Behörde innerhalb eines Monats nach dem Datum der Absendung dieses internationalen Recherchenberichts eine Stellungnahme vorlegen.

6. Folgende Abbildung der **Zeichnungen** ist mit der Zusammenfassung zu veröffentlichen: Abb. Nr. 1

wie vom Anmelder vorgeschlagen

weil der Anmelder selbst keine Abbildung vorgeschlagen hat.

weil diese Abbildung die Erfindung besser kennzeichnet.

keine der Abb.

INTERNATIONAHLER RECHERCHENBERICHT

internationales Aktenzeichen

PCT/EP 00/06028

A. KLASIFIZIERUNG DES ANMELDUNGSGEGENSTANDES
IPK 7 B41J2/005 B41M1/10

Nach der Internationalen Patentklassifikation (IPK) oder nach der nationalen Klassifikation und der IPK

B. RECHERCHIERTE GEBIETE

Recherchierte Mindestprüfstoff (Klassifikationssystem und Klassifikationssymbole)

IPK 7 B41J B41M B41F

Recherchierte aber nicht zum Mindestprüfstoff gehörende Veröffentlichungen, soweit diese unter die recherchierten Gebiete fallen

Während der internationalen Recherche konsultierte elektronische Datenbank (Name der Datenbank und evtl. verwendete Suchbegriffe)

EPO-Internal, PAJ, WPI Data

C. ALS WESENTLICH ANGESEHENE UNTERLAGEN

Kategorie°	Bezeichnung der Veröffentlichung, soweit erforderlich unter Angabe der in Betracht kommenden Teile	Betr. Anspruch Nr.
X	US 5 856 836 A (SILVERBROOK KIA) 5. Januar 1999 (1999-01-05) Spalte 6, Zeile 30 - Zeile 49 Spalte 10, Zeile 41 - Spalte 11, Zeile 65; Abbildung 18 ---	1, 4, 5, 7, 15
X	US 5 886 722 A (KUEHNLE MANFRED R) 23. März 1999 (1999-03-23) Spalte 4, Absatz 3 - Absatz 4; Abbildungen 3A, 3B, 3C ---	1, 3, 7, 15
X	US 5 745 128 A (LAM SI-TY ET AL) 28. April 1998 (1998-04-28) Spalte 6, Zeile 45 - Spalte 7, Absatz 1; Abbildungen 5A, 6A, 6C, 6D Spalte 10, Zeile 35 - Zeile 47 ---	1, 12, 15-17
A	---	18, 19
		-/-

Weitere Veröffentlichungen sind der Fortsetzung von Feld C zu entnehmen

Siehe Anhang Patentfamilie

° Besondere Kategorien von angegebenen Veröffentlichungen :	
A Veröffentlichung, die den allgemeinen Stand der Technik definiert, aber nicht als besonders bedeutsam anzusehen ist	*T* Spätere Veröffentlichung, die nach dem internationalen Anmelde datum oder dem Prioritätsdatum veröffentlicht worden ist und mit der Anmeldung nicht kollidiert, sondern nur zum Verständnis des der Erfindung zugrundeliegenden Prinzips oder der ihr zugrundeliegenden Theorie angegeben ist
E älteres Dokument, das jedoch erst am oder nach dem internationalen Anmelde datum veröffentlicht worden ist	*X* Veröffentlichung von besonderer Bedeutung; die beanspruchte Erfindung kann allein aufgrund dieser Veröffentlichung nicht als neu oder auf erforderlicher Tätigkeit beruhend betrachtet werden
L Veröffentlichung, die geeignet ist, einen Prioritätsanspruch zweifelhaft erscheinen zu lassen, oder durch die das Veröffentlichungsdatum einer anderen im Recherchebericht genannten Veröffentlichung belegt werden soll oder die aus einem anderen besonderen Grund angegeben ist (wie ausgeführt)	*Y* Veröffentlichung von besonderer Bedeutung; die beanspruchte Erfindung kann nicht als auf erforderlicher Tätigkeit beruhend betrachtet werden, wenn die Veröffentlichung mit einer oder mehreren anderen Veröffentlichungen dieser Kategorie in Verbindung gebracht wird und diese Verbindung für einen Fachmann naheliegend ist
O Veröffentlichung, die sich auf eine mündliche Offenbarung, eine Benutzung, eine Ausstellung oder andere Maßnahmen bezieht	*&* Veröffentlichung, die Mitglied derselben Patentfamilie ist
P Veröffentlichung, die vor dem internationalen Anmelde datum, aber nach dem beanspruchten Prioritätsdatum veröffentlicht worden ist	

Datum des Abschlusses der internationalen Recherche Absendedatum des internationalen Rechercheberichts

10. Oktober 2000

18/10/2000

Name und Postanschrift der Internationalen Recherchenbehörde
Europäisches Patentamt, P.B. 5818 Patentlaan 2
NL - 2280 HV Rijswijk
Tel. (+31-70) 340-2040, Tx. 31 651 epo nl,
Fax: (+31-70) 340-3016

Bevollmächtigter Bediensteter

Wehr, W

INTERNATIONALER RECHERCHENBERICHT

Internationales Aktenzeichen

PCT/EP 00/06028

C.(Fortsetzung) ALS WESENTLICH ANGESEHENE UNTERLAGEN

Kategorie*	Bezeichnung der Veröffentlichung, soweit erforderlich unter Angabe der in Betracht kommenden Teile	Betr. Anspruch Nr.
A	EP 0 756 544 A (OCE PRINTING SYSTEMS GMBH) 5. Februar 1997 (1997-02-05) in der Anmeldung erwähnt Anspruch 1 -----	1, 15, 18, 19

INTERNATIONAL SEARCH REPORT

Information on patent family members

International Application No

PCT/EP 00/06028

Patent document cited in search report	Publication date	Patent family member(s)			Publication date
US 5856836	A 05-01-1999	AU 5538296	A 30-10-1996	BR 9606314	A 02-09-1997
		CN 1150776	A 28-05-1997	DE 69603429	D 02-09-1999
		DE 69603429	T 27-01-2000	EP 0765236	A 02-04-1997
		JP 10501765	T 17-02-1998	WO 9632277	A 17-10-1996
US 5886722	A 23-03-1999	NONE			
US 5745128	A 28-04-1998	DE 69320308	D 17-09-1998	DE 69320308	T 17-12-1998
		EP 0600712	A 08-06-1994	JP 6293140	A 21-10-1994
EP 0756544	A 05-02-1997	DE 59405497	D 23-04-1998	JP 9511459	T 18-11-1997
		US 5760808	A 02-06-1998	WO 9529063	A 02-11-1995

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**VERTRAG ÜBER DIE INTERNATIONALE ZUSAMMENARBEIT AUF DEM
GEBIET DES PATENTWESENS**

REC'D 08 FEB 2001
WIPO PCT

PCT

INTERNATIONALER VORLÄUFIGER PRÜFUNGSBERICHT

(Artikel 36 und Regel 70 PCT)

Aktenzeichen des Anmelders oder Anwalts 99 0601 P	WEITERES VORGEHEN	siehe Mitteilung über die Übersendung des internationalen vorläufigen Prüfungsberichts (Formblatt PCT/IPEA/416)	
Internationales Aktenzeichen PCT/EP00/06028	Internationales Anmeldedatum (Tag/Monat/Jahr) 28/06/2000	Prioritätsdatum (Tag/Monat/Tag) 30/06/1999	
Internationale Patentklassifikation (IPK) oder nationale Klassifikation und IPK B41J2/005			
Anmelder OCE PRINTING SYSTEMS GMBH			

<p>1. Dieser internationale vorläufige Prüfungsbericht wurde von der mit der internationalen vorläufigen Prüfung beauftragten Behörde erstellt und wird dem Anmelder gemäß Artikel 36 übermittelt.</p> <p>2. Dieser BERICHT umfaßt insgesamt 5 Blätter einschließlich dieses Deckblatts.</p> <p><input type="checkbox"/> Außerdem liegen dem Bericht ANLAGEN bei; dabei handelt es sich um Blätter mit Beschreibungen, Ansprüchen und/oder Zeichnungen, die geändert wurden und diesem Bericht zugrunde liegen, und/oder Blätter mit vor dieser Behörde vorgenommenen Berichtigungen (siehe Regel 70.16 und Abschnitt 607 der Verwaltungsrichtlinien zum PCT).</p> <p>Diese Anlagen umfassen insgesamt Blätter.</p>
<p>3. Dieser Bericht enthält Angaben zu folgenden Punkten:</p> <ul style="list-style-type: none"> I <input checked="" type="checkbox"/> Grundlage des Berichts II <input type="checkbox"/> Priorität III <input type="checkbox"/> Keine Erstellung eines Gutachtens über Neuheit, erfinderische Tätigkeit und gewerbliche Anwendbarkeit IV <input type="checkbox"/> Mangelnde Einheitlichkeit der Erfindung V <input checked="" type="checkbox"/> Begründete Feststellung nach Artikel 35(2) hinsichtlich der Neuheit, der erfinderischen Tätigkeit und der gewerblichen Anwendbarkeit; Unterlagen und Erklärungen zur Stützung dieser Feststellung VI <input type="checkbox"/> Bestimmte angeführte Unterlagen VII <input checked="" type="checkbox"/> Bestimmte Mängel der internationalen Anmeldung VIII <input type="checkbox"/> Bestimmte Bemerkungen zur internationalen Anmeldung

Datum der Einreichung des Antrags 07/11/2000	Datum der Fertigstellung dieses Berichts 05.02.2001
Name und Postanschrift der mit der internationalen vorläufigen Prüfung beauftragten Behörde: Europäisches Patentamt D-80298 München Tel. +49 89 2399 - 0 Tx: 523656 epmu d Fax: +49 89 2399 - 4465	Bevollmächtigter Bediensteter Findeli, B Tel. Nr. +49 89 2399 2372



**INTERNATIONALER VORLÄUFIGER
PRÜFUNGSBERICHT**

Internationales Aktenzeichen PCT/EP00/06028

I. Grundlage des Berichts

1. Dieser Bericht wurde erstellt auf der Grundlage (*Ersatzblätter, die dem Anmeldeamt auf eine Aufforderung nach Artikel 14 hin vorgelegt wurden, gelten im Rahmen dieses Berichts als "ursprünglich eingereicht" und sind ihm nicht beigefügt, weil sie keine Änderungen enthalten.:*)
Beschreibung, Seiten:

1-18 ursprüngliche Fassung

Patentansprüche, Nr.:

1-19 ursprüngliche Fassung

Zeichnungen, Blätter:

1/4-4/4 ursprüngliche Fassung

2. Hinsichtlich der **Sprache**: Alle vorstehend genannten Bestandteile standen der Behörde in der Sprache, in der die internationale Anmeldung eingereicht worden ist, zur Verfügung oder wurden in dieser eingereicht, sofern unter diesem Punkt nichts anderes angegeben ist.

Die Bestandteile standen der Behörde in der Sprache: zur Verfügung bzw. wurden in dieser Sprache eingereicht; dabei handelt es sich um

- die Sprache der Übersetzung, die für die Zwecke der internationalen Recherche eingereicht worden ist (nach Regel 23.1(b)).
- die Veröffentlichungssprache der internationalen Anmeldung (nach Regel 48.3(b)).
- die Sprache der Übersetzung, die für die Zwecke der internationalen vorläufigen Prüfung eingereicht worden ist (nach Regel 55.2 und/oder 55.3).

3. Hinsichtlich der in der internationalen Anmeldung offenbarten **Nucleotid- und/oder Aminosäuresequenz** ist die internationale vorläufige Prüfung auf der Grundlage des Sequenzprotokolls durchgeführt worden, das:

- in der internationalen Anmeldung in schriftlicher Form enthalten ist.
- zusammen mit der internationalen Anmeldung in computerlesbarer Form eingereicht worden ist.
- bei der Behörde nachträglich in schriftlicher Form eingereicht worden ist.
- bei der Behörde nachträglich in computerlesbarer Form eingereicht worden ist.
- Die Erklärung, daß das nachträglich eingereichte schriftliche Sequenzprotokoll nicht über den Offenbarungsgehalt der internationalen Anmeldung im Anmeldezeitpunkt hinausgeht, wurde vorgelegt.
- Die Erklärung, daß die in computerlesbarer Form erfassten Informationen dem schriftlichen Sequenzprotokoll entsprechen, wurde vorgelegt.

4. Aufgrund der Änderungen sind folgende Unterlagen fortgefallen:

**INTERNATIONALER VORLÄUFIGER
PRÜFUNGSBERICHT**

Internationales Aktenzeichen PCT/EP00/06028

Beschreibung, Seiten:
 Ansprüche, Nr.:
 Zeichnungen, Blatt:

5. Dieser Bericht ist ohne Berücksichtigung (von einigen) der Änderungen erstellt worden, da diese aus den angegebenen Gründen nach Auffassung der Behörde über den Offenbarungsgehalt in der ursprünglich eingereichten Fassung hinausgehen (Regel 70.2(c)).

(Auf Ersatzblätter, die solche Änderungen enthalten, ist unter Punkt 1 hinzuweisen; sie sind diesem Bericht beizufügen).

6. Etwaige zusätzliche Bemerkungen:

V. Begründete Feststellung nach Artikel 35(2) hinsichtlich der Neuheit, der erfinderischen Tätigkeit und der gewerblichen Anwendbarkeit; Unterlagen und Erklärungen zur Stützung dieser Feststellung

1. Feststellung

Neuheit (N)	Ja: Ansprüche 1-19
	Nein: Ansprüche
Erfinderische Tätigkeit (ET)	Ja: Ansprüche 1-19
	Nein: Ansprüche
Gewerbliche Anwendbarkeit (GA)	Ja: Ansprüche 1-19
	Nein: Ansprüche

2. Unterlagen und Erklärungen
siehe Beiblatt

VII. Bestimmte Mängel der internationalen Anmeldung

Es wurde festgestellt, daß die internationale Anmeldung nach Form oder Inhalt folgende Mängel aufweist:
siehe Beiblatt

Zu Punkt V

Begründete Feststellung nach Artikel 35(2) hinsichtlich der Neuheit, der erfinderischen Tätigkeit und der gewerblichen Anwendbarkeit; Unterlagen und Erklärungen zur Stützung dieser Feststellung

- 1) Die Ansprüche 1 und 15 betreffen ein Verfahren und eine Vorrichtung zum Übertragen einer Druckflüssigkeit auf ein Trägermaterial, mit einer Anschlußeinheit zum Empfangen von Druckdaten, einer Aufnahmeeinheit für eine Druckflüssigkeit, und einer Umdruckeinheit.

Solch ein Verfahren und solch eine Vorrichtung sind aus dem nächstkommenen Stand der Technik gemäß Dokument WO-A-95/29063 bekannt.

Der Gegenstand des Anspruchs 1 unterscheidet sich von diesem Verfahren und von dieser Vorrichtung:

- (i) durch eine Einheit zum Verändern der Oberflächenspannung der für ein betreffendes Bildelement vorgesehenen Druckflüssigkeit abhängig von den Druckdaten,
- (ii) dadurch daß die Umdruckeinheit derart zur Aufnahmeeinheit angeordnet ist, daß ohne wesentliche Volumenveränderung ein vorgegebenes Druckflüssigkeitsvolumen mit einer ersten Oberflächenspannung das Trägermaterial benetzt, und
- (iii) dadurch daß Druckflüssigkeit mit einer von der ersten Oberflächenspannung abweichenden zweiten Oberflächenspannung das Trägermaterial nicht berührt.

Diese unterscheidende Merkmale bewirken, daß mit wenig Energie gedruckt werden kann.

Die Aufgabenstellung der Anmeldung war somit, ein Verfahren und eine Vorrichtung zum Übertragen einer Druckflüssigkeit auf ein Trägermaterial anzugeben, die einfach sind, und mit wenig Energie auskommen.

Die Lösung dieser Aufgabe ist aus dem, im Recherchenbericht zitierten Stand der Technik weder bekannt, noch wird sie durch ihn nahegelegt. Insbesondere

- offenbart keines der Dokumente US-A-5 856 836, US-A-5 886 722, US-A-5 745 128 die Merkmale (i), (ii) und (iii).
- 2) Die abhängigen Ansprüche 2-14, 16-19 betreffen weitere Ausgestaltungen des Verfahrens und der Druckvorrichtung und genügen ebenfalls den Erfordernissen des PCT.

Zu Punkt VII

Bestimmte Mängel der internationalen Anmeldung

- 1) Die unabhängigen Ansprüche 1,15 sind nicht in der zweiteiligen Form nach Regel 6.3 b) PCT abgefaßt.
- 2) Beschreibungsseite 1, Zeile 20: die Patentnummer EP-B-0 756 566 ist falsch. Die richtige Nummer ist EP-B-0 756 544. Alternativ hätte diese Patentnummer auch durch die Veröffentlichungsnummer WO-A-95/29063 ersetzt werden können.
- 3) Beschreibungsseite 7, Zeile 33: die Nummer 14 (Anspruch 14) ist falsch. Die richtige Nummer ist 15 (Anspruch 15).

S P E C I F I C A T I O N

T I T L E

"METHOD AND PRINTER DEVICE FOR TRANSFERRING PRINTING FLUID
ONTO A CARRIER MATERIAL AS WELL AS APPERTAINING
5 PRINTING DRUM"

BACKGROUND OF THE INVENTION

The invention is directed to a method wherein print data define the picture elements of a print image to be printed onto the carrier material. Water-based or solvent-based, chromatic fluids are employed as a printing fluid. The carrier material, 10 for example, is white paper or plastic film. The print data contain one or more bit places per picture element. For example, the value one in a bit place indicates that a black picture element is to be printed. The value zero in a bit place indicates that no printing fluid is to be applied on the picture element. The picture element retains the color of the carrier material.

15 European Letters Patent EP 0 756 566 B1 discloses a thermoelectric printing unit for transferring an ink onto a recording medium. The printing unit contains a printing drum with print elements arranged matrix-like that respectively contain a depression for the acceptance of ink. The ink is introduced into the depressions from the outside. A heating element, with whosethe assistance of which 20 the ink is expelled upon vapor formation dependent on the print data, is located in each depression.

US-A-4,275,290 discloses a thermoelectric ink printing unit wherein ink is heated in depressions, whereupon surface tension and volume change. The ink flows into widened portions arranged opposite a recording medium. A meniscus forming 25 thereat inks the recording medium.

Further, US-A-4,675,694 discloses a thermoelectric ink printing unit wherein solid ink is heated. After becoming molten, the ink expands and moistens a recording medium in character-dependent fashion.

DE-A1-19718906, which does not enjoy prior publication, likewise discloses a thermoelectric ink printing unit having a hollow drum with depressions arranged thereon in matrix-like fashion. A gas bubble is generated in the ink via a laser, whereupon the ink expands and moistens a recording medium.

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SUMMARY OF THE INVENTION

An object of the invention is to specify a further method for transferring printing fluid onto a carrier material. Moreover, a printer device and a printing drum are to be recited that are suitable for the implementation of the method.

~~The object relating to a method is achieved by a method having the method steps indicated in patent claim 1. Developments are indicated in the subclaims~~ According to the method and system of the invention for transferring printing fluid onto a carrier material, with print data defining picture elements of a print image to be printed onto the carrier material. A surface tension of a prescribed volume of a printing fluid is influenced when printing a picture element dependent on the print data belonging to the picture element wherein without significant change in volume, the printing fluid has either a first surface tension which moistens the carrier material or has a second surface tension deviating from the first surface tension, the printing fluid having the second surface tension not touching the carrier material.

The invention proceeds on the basis of the perception that, given a modification of the surface tension of a fluid that adjoins a solid body, a wetting angle defined by the boundary surface tension between the surface of the fluid and the seating surface and by the seating surface itself likewise changes. When the fluid is located in a vessel, then the change of the wetting angle forces a change in curvature on the surface of the fluid. The change in curvature results therein that in at least sub-areas of the surface moving by a specific differential distance, for example rising or, respectively, lower lowering. The differential distance is dependent on the vessel size and amounts, for example, to 10 μm through 30 μm given a print resolution of 600 dpi (dots per inch). When the carrier material lies against an acceptance unit for transporting the printing fluid for the individual picture elements

or when the carrier material is arranged at a distance from the printing fluid that corresponds to the differential distance, then, dependent on the surface tension given a large wetting angle or, respectively, great curvature, a moistening and, thus, an inking of the carrier material occurs when the printing fluid advances up to the carrier
5 material. When, however, the wetting angle or, respectively, the curvature is small, then the printing fluid does not reach the carrier material, and the carrier material retains its base color in the region lying opposite the printing fluid.

According to this principle, the surface tension of a printing fluid is influenced in the inventive method when printing a picture element, being influenced
10 dependent of a print datum belonging to the appertainingcorresponding picture element. The carrier material to be printed is arranged at a distance from the printing fluid whereat printing fluid having a first surface tension moistens the carrier material and whereat printing fluid having a second surface tension deviating from the first surface tension does not moisten the carrier material. The variation of the surface
15 tension to be implemented in the inventive method requires far less energy than the acceleration of a drop of ink. In the inventive method, the printing fluid -- after the moistening of the carrier material -- proceeds to the carrier material due to the adhesion effect between carrier material and printing fluid.

In a development of the inventive method, the first surface tension is
20 greater than the second surface tension. The curvature of the surface deriving given the first surface tension is greater than the curvature deriving given the second surface tension. A central sub-area of the printing fluid thus projects farther out given the first surface tension than given the second surface tension.

In a next development of the inventive method, the first surface tension
25 has a first value at which the surface of the printing fluid arcs outward. The second surface tension, in contrast, has a value at which the surface of the printing fluid is flat or even arcs inward. The direction of the arc is thereby seen proceeding from the inside of the fluid. The differential distance given this development is very large, so that it is possible to conduct the carrier material past at a greater spacing from a vessel

for the acceptance of the printing fluid. An abrasion of the carrier material and a wear at the edges of the vessel are thus avoided. When the printing fluid arcs inward at the second surface tension, then the carrier material can be placed against the edge of a vessel for the acceptance of the printing fluid.

5 In one development of the inventive method, the surface tension is varied in that the temperature of the printing fluid is varied. The heating of the fluid usually leads to a reduction of the surface tension. Photoflash lamps, laser beams or laser diodes are employed as heat sources. When fluid additive such as, for example, tensides contained in the printing fluid evaporate given variation of the temperature, 10 then this leads to an increase in the surface tension. Tensides are surface-active substances that reduce the surface tension. An increase in the surface tension consequently arises when these fluid additives are removed. An evaporation of the tensides can already be compelled due to a relatively small temperature change. The surface tension rises more sharply due to the removal of the fluid additives than it 15 drops due to the heating. In this opposed process, thus; the increase in the surface tension dominates, this leading to an increase in the wetting angle and, thus; to an increase of the curvature on the surface of the printing fluid.

In another development, the surface tension is varied due to a variation of the ionization in the printing fluid. The ionization can be varied by introducing 20 ionized particles or by means of electrical fields as well. The variation of the ionization also enables the use of heat-sensitive printing fluids.

In one development of the inventive method, the surface tension of a prescribed volume of the printing fluid is varied. The printing fluid to be employed per picture element can be exactly prescribed with the assistance of the prescribed 25 volume. In a next development, the volume is dimensioned such that is corresponds to the printing fluid volume to be applied onto a picture element having the color of the printing fluid. All of the prescribed printing fluid is thus employed. This leads to a thrifty printing event. Collecting printing fluid that is not needed is eliminated.

When, in another development, the volume is prescribed by the capacity volume of a depression, then the filling of the volume is simple since the printing fluid runs over the edge of the depression as soon as the depression has been filled with printing fluid. The quantity of fluid to be employed per picture element is

5 exactly prescribed by the capacity volume of the depression and is independent of the printing speed. Since, following a stripping of fluid residues projecting beyond the depression, the printing fluid is topically limited by the edge of the depression, the boundaries of the picture elements can be precisely prescribed. The depression forms a vessel that is very well-suited for producing an optimally great differential distance

10 on the surface of the printing fluid given a change of the surface tension.

In a next development of the inventive method, the depressions are arranged in matrix-like fashion, preferably on a drum-shaped surface. The resolution of the printer device is prescribed by the spacing and the diameter of the depressions, i.e. the plurality of picture elements to be printed per unit of area.

15 In a development of the inventive method, the surface tension is influenced due to the action of a radiation source directed through the opening of the depression into the inside of the depression. This development is based on the perception that the surface tension changes with a certain inertia. It is thus possible to first set the surface tension and to subsequently transport the printing fluid to the

20 carrier material. The surface tension remains unmodified during the transport, so that the carrier material is moistened or remains unmoistened dependent on the surface tension. In this development, the radiation of the radiation source reaches the surface of the fluid without having to pass through the fluid first. The direct irradiation of the surface results therein that in fluid additives located at the surface of the fluid ~~can~~

25 be being influenced with a lower amount of energy. For example, the fluid additives are tensides that evaporate given a slight increase in temperature. In this development, the radiation source is arranged outside the vessel for the printing fluid. This results therein that in no built-in parts are being needed in the material of the vessel for the delivery of the energy.

In a next development, the surface tension is modified with the assistance of a temporally and topically drivable radiation source. When the radiation source is clocked according to a timing clock, then the surface tension can be successively set for various picture elements. When a plurality of radiation sources are arranged next to one another, then the surface tensions of various picture elements can be simultaneously set. Given a combination of a temporally and topically driven radiation source, the printing speed can be increased upon employment of reasonable clock rates when, for example, radiation sources for exposing the picture elements of two or more lines are arranged behind one another and are simultaneously actuated.

10 In one development of the inventive method, the printing fluid for all picture elements initially has a lower surface tension that is raised dependent on the print data. The increase in the surface tension can be realized in a simple way, for example by evaporating tensides contained in the printing fluid or by introducing ions into the printing fluid. In this development, the surface tension need not be reduced 15 during printing. However, methods are also applied wherein the printing fluid for all picture elements initially has a higher surface tension and is then reduced dependent on the print data when certain printing fluids are employed for which the reduction of the surface tension is easier to implement than the increase of the surface tension.

20 ~~The object directed to a printer device is achieved by a printer device comprising the features of patent claim 14.~~ The inventive printer device serves for the implementation of the inventive method and the developments thereof. The technical effects recited above thus also apply to the printer device.

25 In one development of the inventive printer device, a unit for modifying the surface tension contains a radiation source that generates thermal radiation and/or electromagnetic radiation and/or a particle beam. When the unit for modifying the surface tension is arranged outside the receptacle unit for the printing fluid, then this receptacle unit can be constructed in a simple way. The invention is also directed to a printing drum for the application of a printing fluid. Depressions for the acceptance of the printing fluid are arranged in matrix-shaped fashion on the printing drum. The

printing drum is free of devices allocated to individual depressions for influencing a physical property of the printing fluid in the respective depression. This means that there are no heating elements or similar elements for delivering energy within the printing drum. The printing drum can be homogeneously made of a uniform material.

5 Regions of the surface of the printing drum in which no depressions lie can be coated with a hydrophobic coating in order to prevent a wetting with printing fluid at these locations.

Exemplary embodiments of the invention are explained below on the basis of the enclosed drawings. Shown therein are:

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BRIEF DESCRIPTION OF THE DRAWINGS

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Figure 1 — illustrates a portion of a printing drum;

Figure 2 — illustrates a printing unit of a printer;

Figure 3 — shows an irradiation device for varying the surface tension of a printing fluid; and

Figure 4 — shows an irradiation unit working according to the scanning principle for varying the surface tension of the printing fluid:-

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DESCRIPTION OF THE PREFERRED EMBODIMENTS

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For the purposes of promoting an understanding of the principles of the invention, reference will now be made to the preferred embodiment illustrated in the drawings and specific language will be used to describe the same. It will nevertheless be understood that no limitation of the scope of the invention is thereby intended, such alterations and further modifications in the illustrated device, and such further applications of the principles of the invention as illustrated therein being contemplated as would normally occur to one skilled in the art to which the invention relates.

Figure 1 shows a longitudinal section along the surface 8 of a printing drum 10. A plurality of depressions are arranged in matrix-like fashion in the surface

8 of the printing drum 10, Figure 1 showing two depressions 12 and 14 thereof. The depressions are arranged next to one another in a row direction. Neighboring depressions 12, 14 have a spacing A from one another that defines the resolution of the printer. A plurality of rows of depressions are arranged behind one another in 5 column direction 18, whereby neighboring depressions within a column also have the spacing A from one another. The depressions are all identically constructed, so that only the structure of the depression 12 shall be explained below.

The depression 12 is fashioneddesigned as a conoidal frustum-shaped recess (see contour 20) and thus has circular cross-sections. The axis of the conoidal frustum lies in the direction of the normal of the surface 8. The conoidal frustum-shaped contour 20 tapers with increasing distance from the surface 8 of the printing drum 10. A bottom surface 24 of the depression 12 has a smaller diameter than the aperture 26 of the depression 12 lying on the surface of the printing drum 10. The circumference of the aperture 26 lies on a circle and determines the shape of the 15 picture elements to be printed.

An all-around sidewall of the depression 12 is obliquely arranged relative to the surface 8 of the printing drum 10. The filling of a chromatic ink 30 is facilitated by the conoidal frustum-shaped fashioningdesign of the depression 12. In addition to conoidal frustum-shaped depressions having a circular cross-section, 20 depressions with an elliptical or a polygonal cross-section are also employed.

When the ink 30 is situated within the depression, it is held within the depression 12 by capillary forces. The capillary forces are greater than the force of gravity exerted on the ink 30, so that the ink 30 also remains within the depression 12 when the aperture 26 is directed down, i.e. toward the center of the earth. After the 25 ink 30 has been filled in, the surface 32 thereof has a surface tension that leads to a convexconcave curvature, i.e. the surface 326 of the ink 30 is arced inward. The surface 32 is in a condition I wherein a wetting angle RI has a value of approximately 45°. The wetting angle 30 [sic] lies between a vector V1 of the surface tension on the surface of ink 30 and the sidewall 28. The vector V1 begins at the edge of the

depression 12, i.e. at a location at which the boundary between fluid 30 and sidewall 28 or, ~~respectively~~, surface 8 lies.

The volume capacity of the depression 12 is selected such that exactly that quantity of ink 30 that is required for printing a single picture element can be held 5 therein. How a condition II of the surface 36 of the ink 34 [sic] influences the printing event shall be explained below on the basis of a printing fluid 34 within the depression 14. The ink 34 also had an inwardly arced, i.e. convexconcave, surface after being filled into the depression 14. The surface tension of the ink 34, however, was increased as a result of one of the measurestechniques explained below on the 10 basis of Figures 2 through 4, as a result whereof the surface 36 has arced outward in convex fashion. A wetting angle RII between a surface tension vector VII and the sidewall of the depression 14 has a value somewhat above 90° . The vector VII begins at the sidewall of the depression 14 and proceeds in the direction of the surface tension of the surface 36. The starting point of the surface tension vector VII lies at 15 the boundary between printing fluid 34 and the sidewall of the depression 14. A middle region 38 of the surface 36 projects beyond the surface 8 of the printing drum 10 by a distance B. When the depression 14 is conducted past paper to be printed at a distance that is smaller than the distance B, then a wetting of the paper occurs. The adhesion forces between paper and printing fluid 34 are greater than the capillary 20 forces between printing fluid 34 and depression 14. All of the printing fluid 34 is therefore sucked from the depression 14 and inks a region on the paper that is provided for a picture element.

Figure 2 shows a printing unit 50 of a printer. A printing drum 10a rotates counter-clockwise, see arrow 52. The devices explained below are successively 25 arranged along the rotational direction of the printing drum 10a.

At the beginning of a revolution of the printing drum 10a, the depressions extending in the longitudinal direction of the printing drum 10a for printing a line are free of printing fluid; see position P1. Ink 56 is filled into the depressions of a row at an inking station 54. The inking station 54 contains a scoop drum 58 whose axis

proceeds parallel to the axis of the printing drum 10a. At position P2, the surface of the scoop drum 58 touches the surface of the printing drum 10a. The scoop drum 58 turns in a direction opposite the printing drum 10a; - see arrow 60. The lower part of the scoop drum 58 immerses into the ink 56 held by a reservoir 62, so that the surface 5 of the scoop drum 58 is moistened with ink when it reaches the position P2. As a result of the capillary forces, the ink 56 is sucked from the surface of the scoop drum 58 into the depressions 12, 14 of the printing drum 10a that are located at the position P2.

10 A doctor blade 64 with which the surface of the printing drum 10a is swept so that no ink remains on the surface of the printing drum 10a outside the depressions is located at a position P3. After being swept with the doctor blade 64, the ink in all depressions has a respectively inwardly arced surface.

15 Due to the rotation of the printing drum 10a, the depressions of a row filled with ink 56 are subsequently transported to a position P4 at which an exposure device 70 alters the surface tension in selected depressions. The exposure device 70 contains a tubular photoflash 72 whose longitudinal axis is arranged parallel to the longitudinal axis of the printing drum 10a. A reflector 74 that extends along the photoflash lamp 72 and has an arcuate cross-section is located at that side of the photoflash lamp 72 facing away from the printing drum 10a. The photoflash lamp 72 20 is located approximately in the focus of the reflector 74. The exposure device 70 also contains a row of ceramic cells 76 arranged next to one another whose transparency can be varied with the assistance of a control voltage. Exactly one ceramic cell 76 is located opposite each depression when exposing a row of depressions at the position P4. The ceramic cells 76 are a matter of transparent, ~~ferroelectric~~ferro electric 25 ceramic laminae. Such ceramic laminae are known from optoelectronics. For example, European Letters Patent EP 0 253 300 B1 discloses such ceramic laminae as PLZT elements. However, optoelectronic elements that work according to the Kerr principle are also employed.

The exposure device 70 is controlled by a drive device 78 dependent on printing data 80 that define the picture elements of the print image to be printed. A first output line 82 of the drive device 78 carries a clock signal 84 that clocks the photoflash lamp 72 synchronously with the rotation of the printing drum 10a, so that 5 each row of depressions that is moved past the position P4 is irradiated exactly once by the photoflash lamp 72.

Output lines 86 lead from the drive device 78 to individual ceramic cells 76 of the row of ceramic cells 76. The drive unit 78 drives the ceramic cells 76 such that a ceramic cell 76 under observation is light permeable when the depression lying 10 opposite the appertainingcorresponding ceramic cell contains ink that is to be employed for printing at a position P5 given the next pass. The light coming from the photoflash lamp 72 can then proceed through the appertainingcorresponding ceramic cell 76 and onto the ink. Tensides that are situated on the surface of the ink are evaporated due to the photo-energy. The result is that the surface tension of the ink 15 rises and the wetting angle increases. When, in contrast, the ink situated in a specific depression is not to be employed for printing a picture element, then the ceramic cell 76 lying thereoppositethere opposite is blacked out with the assistance of the drive device 78, so that no light from the photoflash lamp 72 can impinge the depression. The surface tension and the wetting angle of the ink remain unmodified.

20 As explained above with reference to Figure 1, there are depressions at the position P4 after the passing of a row of depressions [sic] wherein the surface of the printing fluid has the condition I. The surface of the ink has the condition II in other depressions.

25 A transfer printing zone 92 is located at the position P5 between the printing drum 10a and a transport roller 90. The longitudinal axis of the transport roller 90 lies parallel to the axis of the printing drum 10a. The transport roller 90 is turned in a direction opposite the transport[sic]printing drum 10a by a transport mechanism (not shown), see arrow 94. Continuous form paper is transported in a

conveying direction 98 between printing drum 10a and transport roller 90. The continuous form paper 96 lies against the surface of the transport roller 90.

Continuous form paper 96 and the surface of the printing drum 10a have the same velocity in the region of the transfer printing zone 92, so that they are at rest relative to one another. That surface of the continuous form paper 96 facing toward toward [sic]the printing drum 10a has a spacing from the surface of the printing drum 10a in the transfer printing zone 92 that is smaller than the spacing B, see Figure 1. The spacing B assures that no abrasion will arise at the continuous form paper 96 and at the printing drum 10a. In another exemplary embodiment, the continuous form paper is pressurepressed against the printing drum 10a by a soft pressure roller. In the region of the transfer printing zone, the continuous form paper 96 is printed at locations that lie opposite depressions whosethat hasve a high surface tension and, thus, hasve a great curvature at the surface, condition II.

After the depressions are transported past the position P5, there are depressions in which ink 56 is still situated. The ink 56 was removed from other depressions when printing in the transfer printing zone 72. A cleaning station 100 is located at a position P6. The cleaning station 100 contains a cleaning drum 102 whose longitudinal axis lies parallel to the longitudinal axis of the printing drum 10a. The cleaning drum turns in a direction opposite the printing drum 10a, see arrow 104. The surface of the cleaning drum 102 and the surface of the printing drum 10a touch at the position P6. The surface of the cleaning drum 102 is fabricated of an absorbent material and suchwhich absorbs ink 56 from the depressions in which ink has remained. Ink that has previously been in the depressions on the printing drum 10a is squeegeed from the cleaning drum 102 with the assistance of a doctor blade 106. The ink that has been squeegeed off runs into a collecting basin 108 arranged under the doctor blade 106. After being transported past the position P6, the depressions on the transfer printing drum 10a are again in their original condition, as was explained above for the position P1. An interconnecting feeder 110 via which the ink dripping down from the doctor blade 106 returns into the reservoir 62 is located between the

collecting basin 108 of the cleaning station 100 and the reservoir 62 of the inking station 54. An ink circulation for ink that was not used is thus closed via the interconnecting feeder 110.

One part of Figure 3 shows a second exemplary embodiment for an exposure device 70a that is employed instead of the exposure device 70. The exposure device 70a likewise contains a photoflash lamp 72a and a reflector 74a that ~~has [sic]have~~ the same structure as the photoflash lamp 72 or, respectively, the reflector 74. However, four rows of ceramic cells 76a, 76b, 76c and 76d are arranged between photoflash lamp 72a and printing drum 10a in the exposure device 70a. Part 10 *a* of Figure 3 shows a side view onto the rows of ceramic cells 76a through 76d that are arranged in the light path between photoflash lamp 72a and printing drum 10a, so that the light coming from the photoflash lamp 72a successively passes through ceramic cells 76a through 76d of different rows. What is referred to as a self-focussing lens 120 is situated between the row of ceramic cells 76a and the printing 15 drum 10a. Such lenses are manufactured of gradient fibers and are known by the ~~tradename~~ trade name SELFOC (also see EP 0 253 300 B1).

A part *b* of Figure 3 shows a front view of the rows of ceramic cells 76a through 76d lying behind one another. Ceramic cells 76a through 76d lying behind one another are respectively offset by a quarter length of a ceramic cell relative to one another. As a result of this offset, printing drums 10a can also be exposed wherein neighboring depressions have a very small spacing A. The terminals of the ceramic cells contained in the rows of ceramic cells 76a through 76d are connected to the drive device 78, so that individual ceramic cells can be separately driven. The arrangement of the ceramic cells 76a through 76d shown in parts *a* and *b* of Figure 3 enables a 20 higher printing speed or, respectively, a higher resolution of the printing event given 25 an unaltered printing speed.

Figure 4 shows an exposure unit 70b working according to the scanning principle that is employed instead of the exposure unit 70. A laser 200 driven by the drive unit 78 emits a laser beam 202 that impinges a polygonal mirror 204. The

5 polygonal mirror 204 turns in a counter-clockwise direction along its longitudinal axis, see arrow 204. Upon rotation of the polygonal mirror 204, the laser beam 202 successively impinges lateral faces 206 of the polygonal mirror 205. Due to the rotation of the polygonal mirror 204, the laser beam 202 is successively reflected by different lateral faces 206 of the polygonal mirror 204 and sweeps across the printing drum 10a along a principal scan direction 208 in a row direction of the depressions. The drive unit 78 drives the laser 200 such that the laser beam 202 impinges 10 depressions to which picture elements to be presented black are allocated. When sweeping across depressions to which white picture elements are allocated, the laser beam 202 is blacked out.

15 A motion in a secondary scan direction, see arrow 52, is generated due to the rotation of the printing drum 10a, so that the next row with depressions is irradiated given incidence of the laser beam 202 onto the next lateral face 206 of the polygonal mirror.

16 While the invention has been illustrated and described in detail in the drawings and foregoing description, the same is to be considered as illustrative and not restrictive in character, it being understood that only the preferred embodiment has been shown and described and that all changes and modifications that come within the spirit of the invention are desired to be protected.

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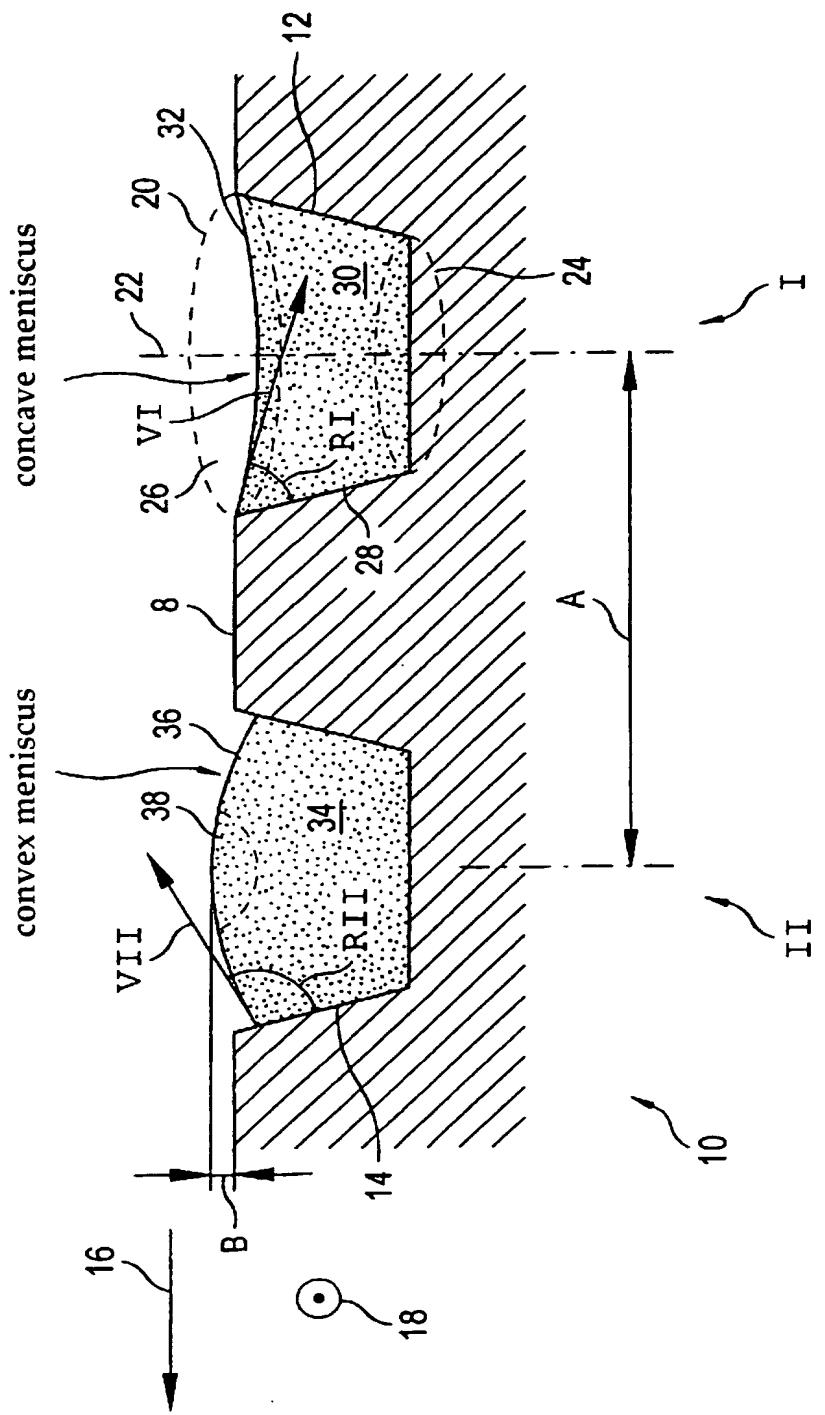


FIG. 1

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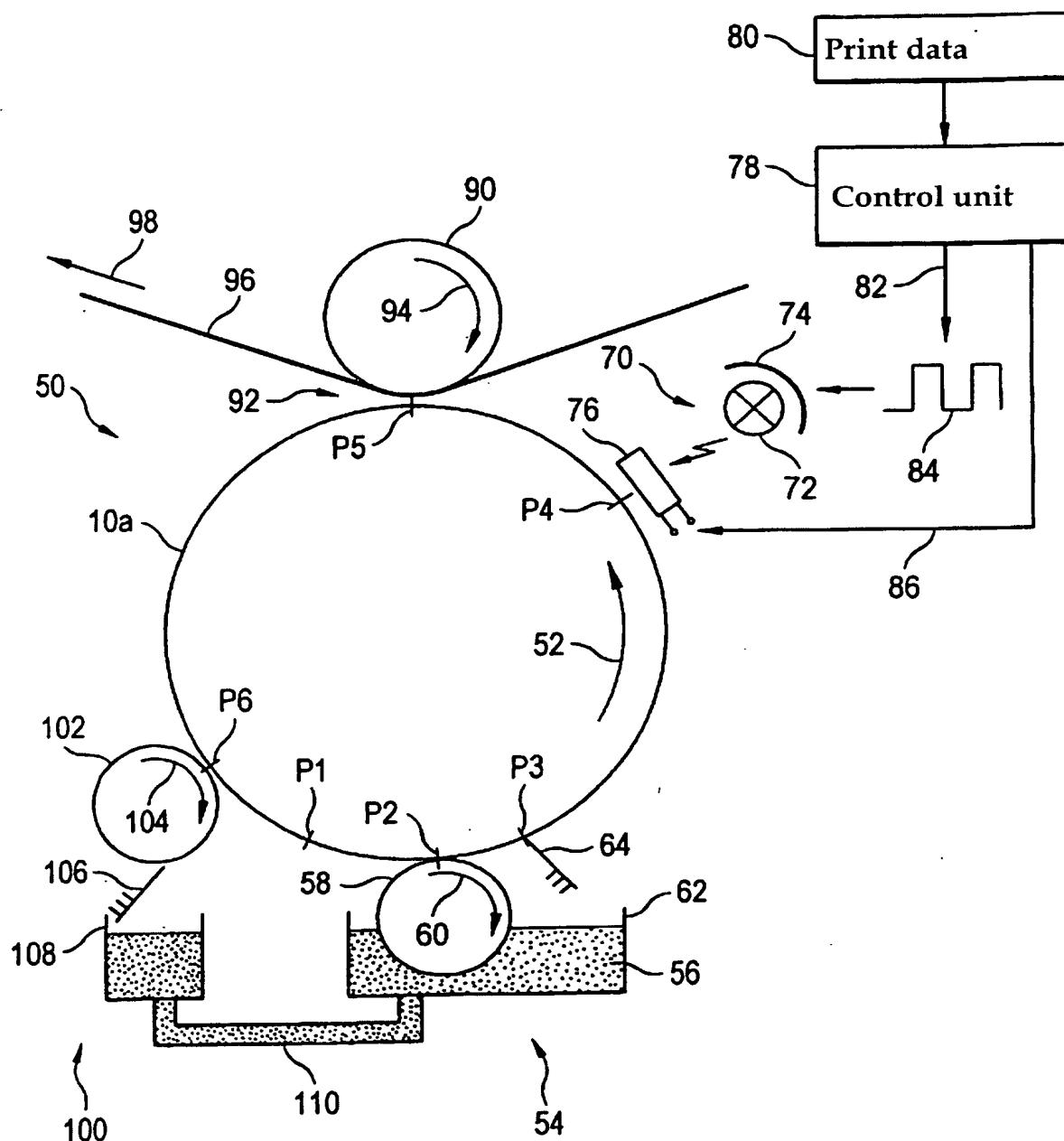


FIG.2

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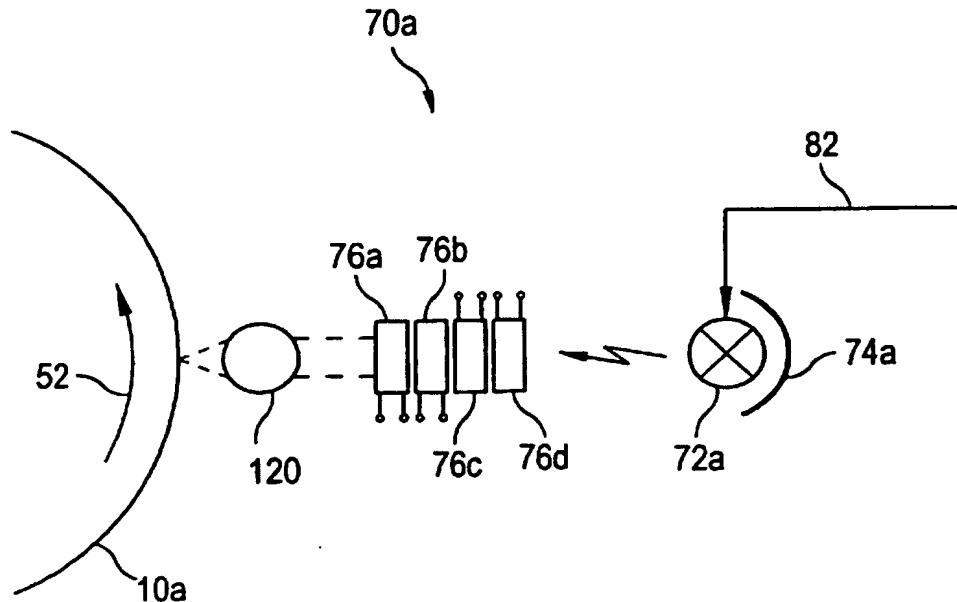


FIG.3A

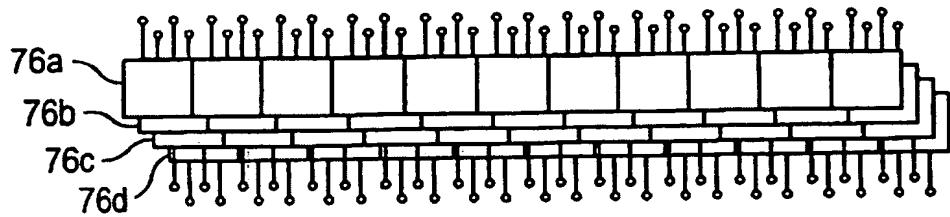


FIG.3B

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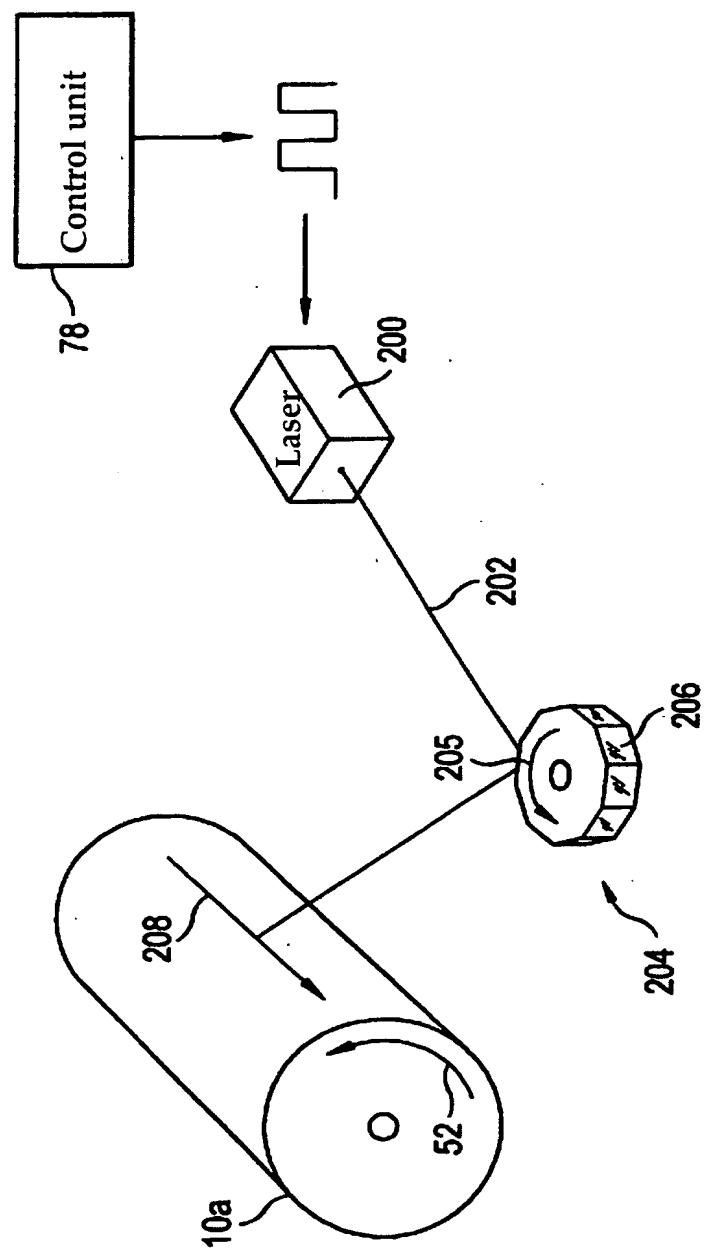


FIG.4